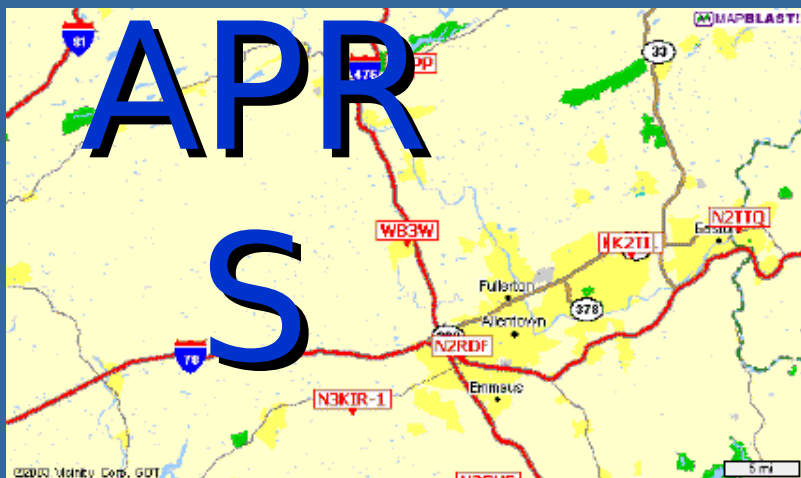




Maps – Mobiles – Users APRS HT and Mobile via GO-32



Updated Oct
2007



What is APRS?

- **APRS** = Automatic Packet Reporting System
- **APRS** was developed in the early 1990's for local tactical digital communications, situational awareness and **TWO-WAY** information exchange using Amateur radio.
- **Not Vehicle Tracking!!!**



What is APRS all about?

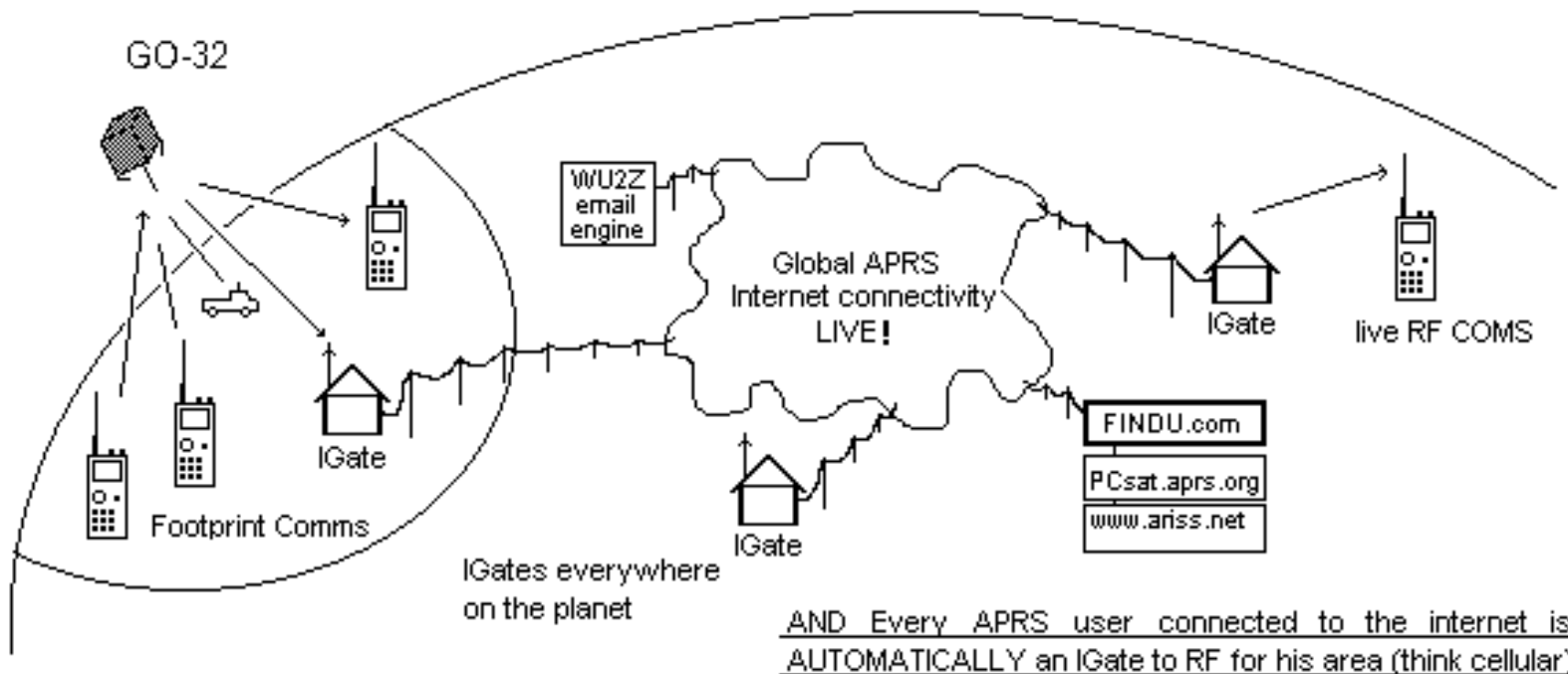
- The APRS System was developed to provide immediate local digital and graphical information exchange between all participants in an event. This includes not only tracking and monitoring position data, but also status, messaging, bulletins all without having to maintain packet connections. Typical data:
 - Positions of all stations and objects
 - Status of all stations
 - Messages, Bulletins and Announcements
 - Weather data and telemetry
 - DF bearings and signal strengths for quick transmitter hunting
 - Local information of value to the traveler
- Typical applications are:
 - Routine local awareness of all ham radio events and assets around you
 - Marathons, races, events and public service
 - Search and rescue
 - Family communications and tracking and one-line emails
 - Mobile-to-mobile global messaging
 - Weather data exchange and display
 - Efficient multi-user Satellite communications



Global Mobile and Portable Satcom

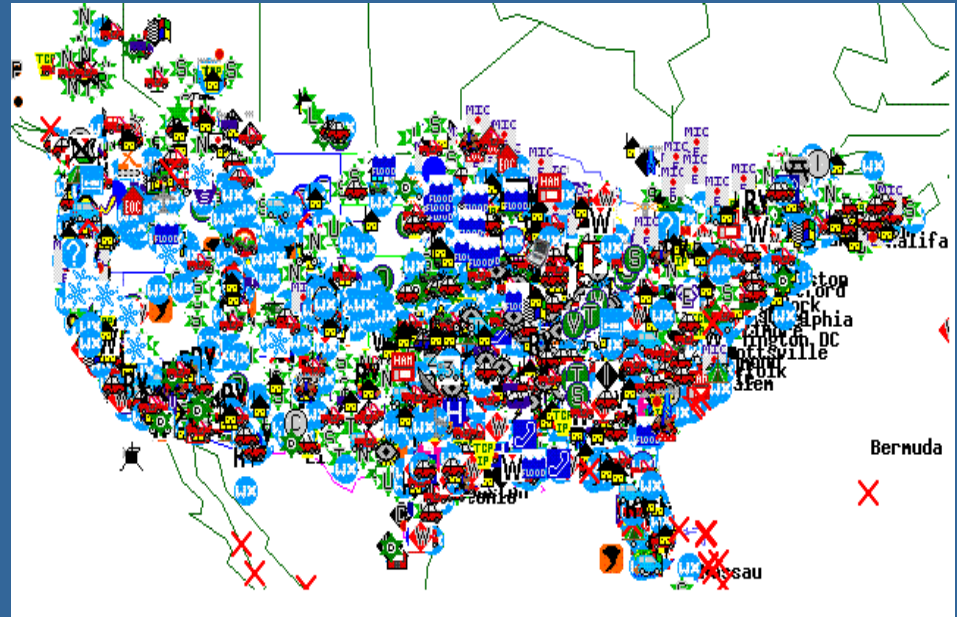
GO-32 APRS Igate System (potential)

(End-to-End Everywhere)

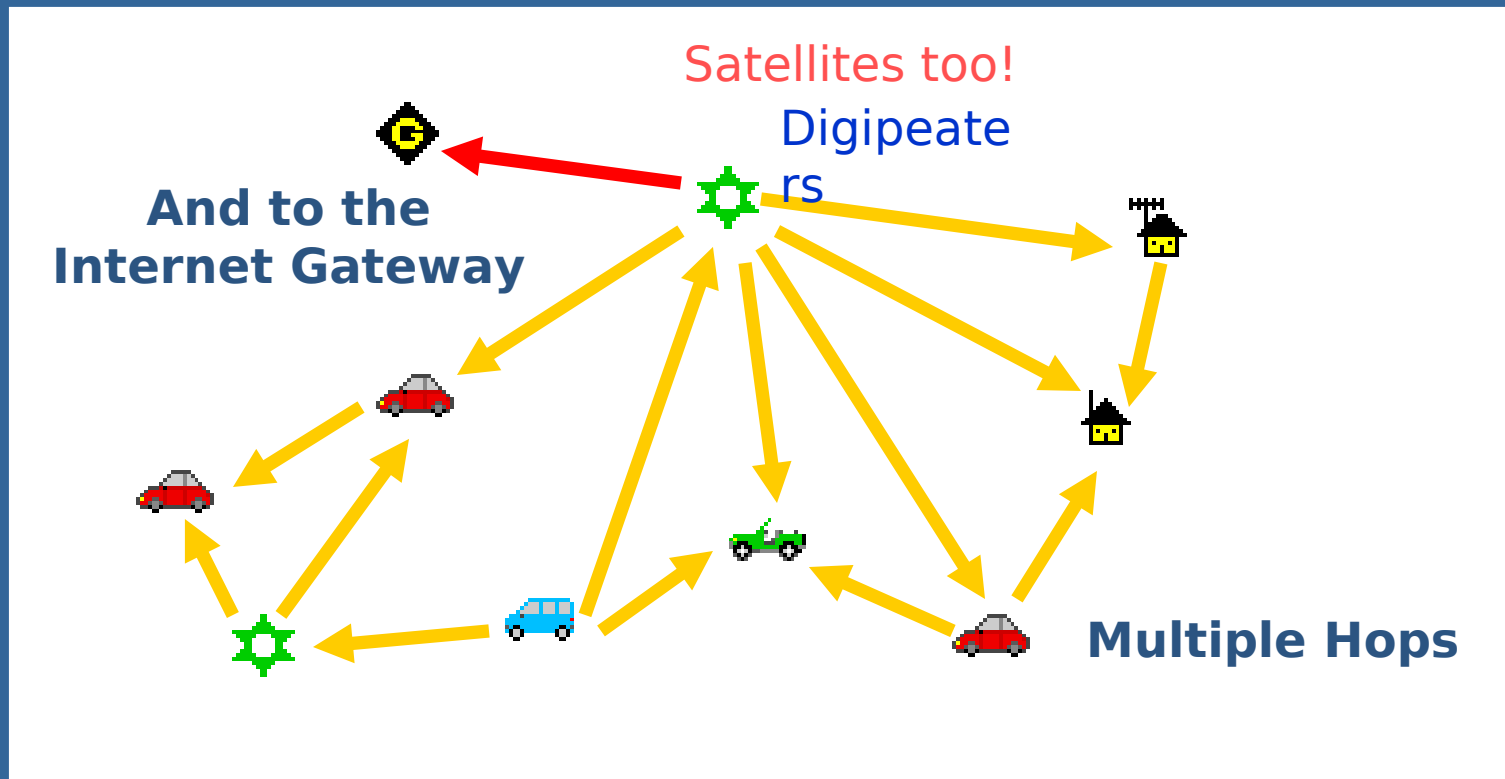


Scope of APRS

- APRS consists of a very large land based wireless network. Almost 30,000 users around the world.
- This network works via RELAYS every 20-30 miles called "digipeaters." And Globally via IGates to the internet.
- APRS is also used via Amateur Satellites in wilderness areas.
- It is also used to monitor telemetry values of weather stations for the National Weather Service (NWS)
- APRS has the capability to quickly relay telemetry values to research centers without the Internet.



The APRS Network



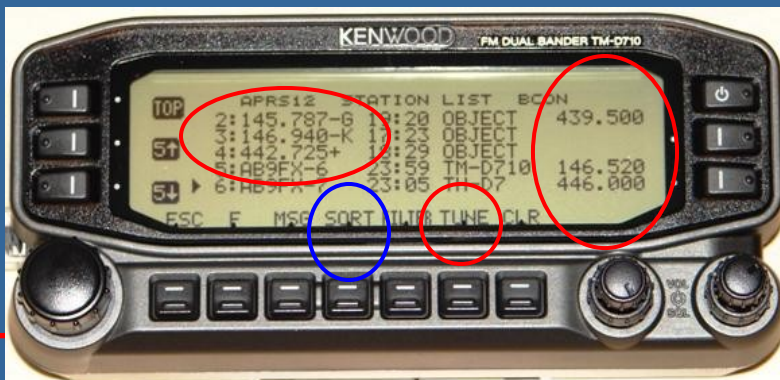
Mobile/Portable Satellite

Kenwood TM-D700A

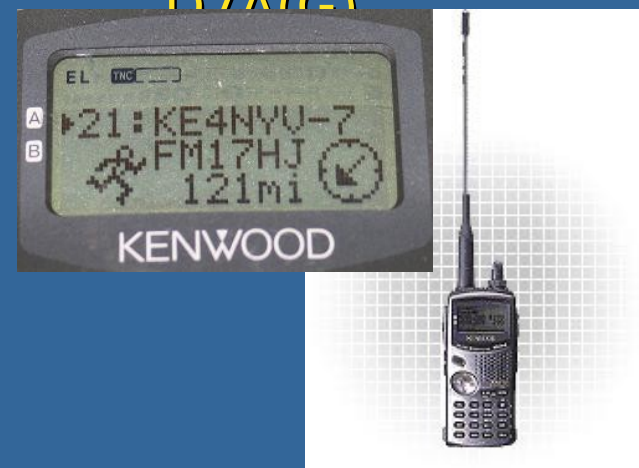
- Dual band 144/440 MHz 50/35 Watts
- Built-in 1200/9600 bps TNC including digipeater
- Built-in screen display of other APRS stations and front-panel send/receive messaging.
- Other APRS station locations are sent to the attached GPS map for display.

TM-D710

- Adds operation Freq to every posit !
- Auto tunes to others with Freq!
- Shows local Voice Repeaters !



Kenwood TH-D7A(G)



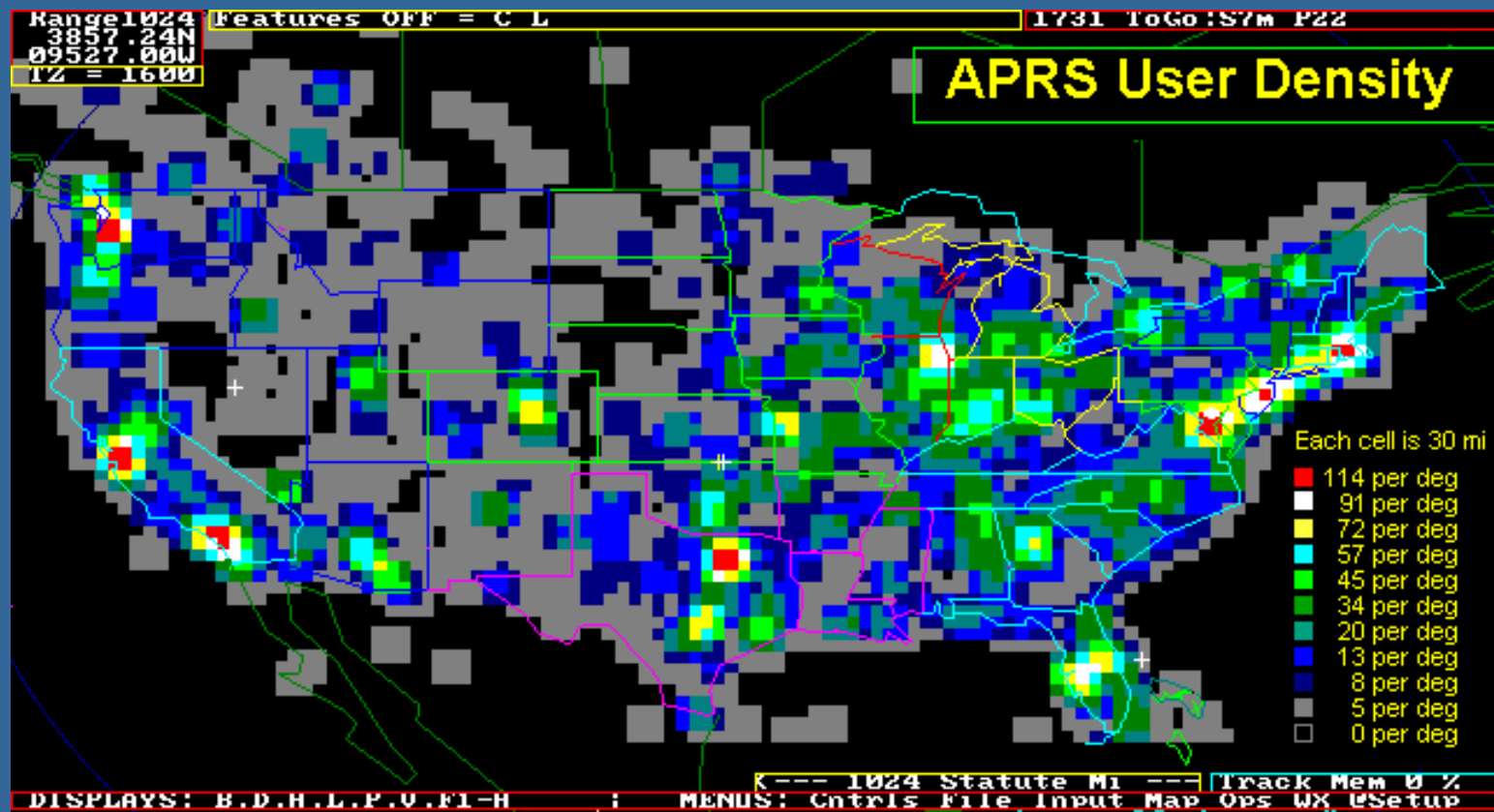
APRS Voice Alert

(For all mobiles!)



- Voice Alert is effectively 3rd Radio channel for the D7 and D700 APRS radios
- By setting the APRS Band, A, to PL-100, but keeping the volume turned up:
 - You won't hear any packets on 144.39 *
 - But you will hear a voice call using PL-100 on 144.39
 - And you will hear* an occasional Ping packet if another D700 comes in line-of-site to you, like a proximity radar alerting you to local presence.
- Great for long haul traveling and meeting other APRS users.





This data is plotted from Steve's FINDU data for 10 days and plotted on APRSdos shows the user density in the USA in Feb 05. Although it appears that most of the USA is low density, remember that a WIDE5-5 launched anywhere in the remotest area will still get to the closer cities and add to the QRM there. And there are 100 times more low density users surrounding these cities hitting them from all sides that really adds up to heavy QRM. We recommend WIDE2-2 in ■ ■ ■ ■ and surrounding areas

The grid size is 30 miles and each is averaged with all 8 of its surrounding adjacent grids.. The file is over 11,000 stations.

But the great news is that the New n-N Paradigm is the right approach. It encourages WIDEn-N everywhere while letting the high density areas trap large values of N to prevent overload in their areas only.

WB4APR



The New-N Paradigm 2005

Factor of 3 to 5 improvement!

❑ **APRS Generic Paths** evolved over 13 years and the presence of many old legacy formats and procedures were really bogging down the network making it saturated and unreliable in busy areas.

❑ In 2005 all **old paths were declared obsolete** (RELAY & WIDE) and the entire APRS system in the US was then focused only on the WIDEn-N type of generic paths with small values of N.

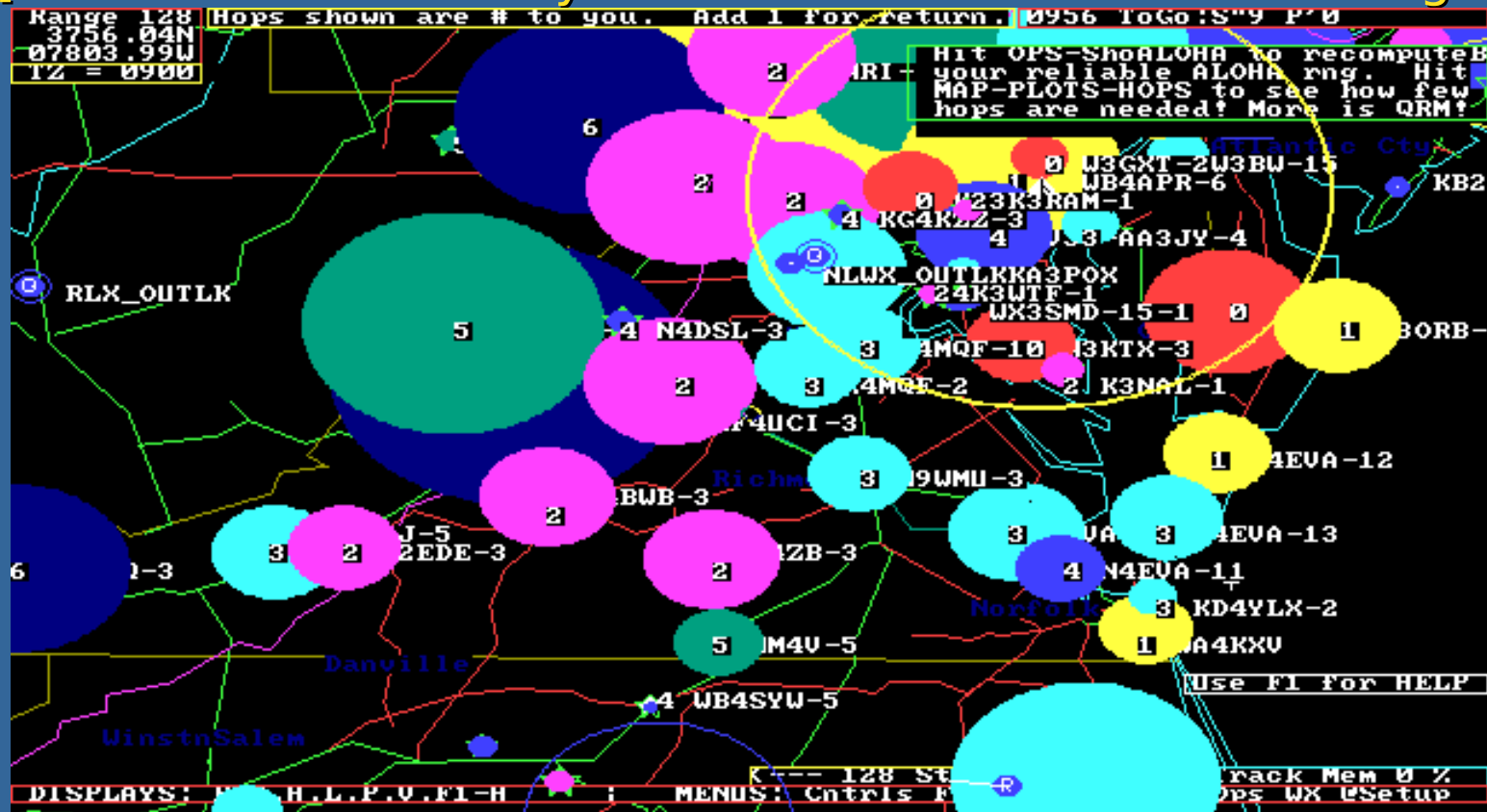
❑ A **WIDEn-N path** goes N hops outward in all directions.

❑ **N=2** in most areas colored on next slide



APRS (ALOHA circle and digipeater hops)

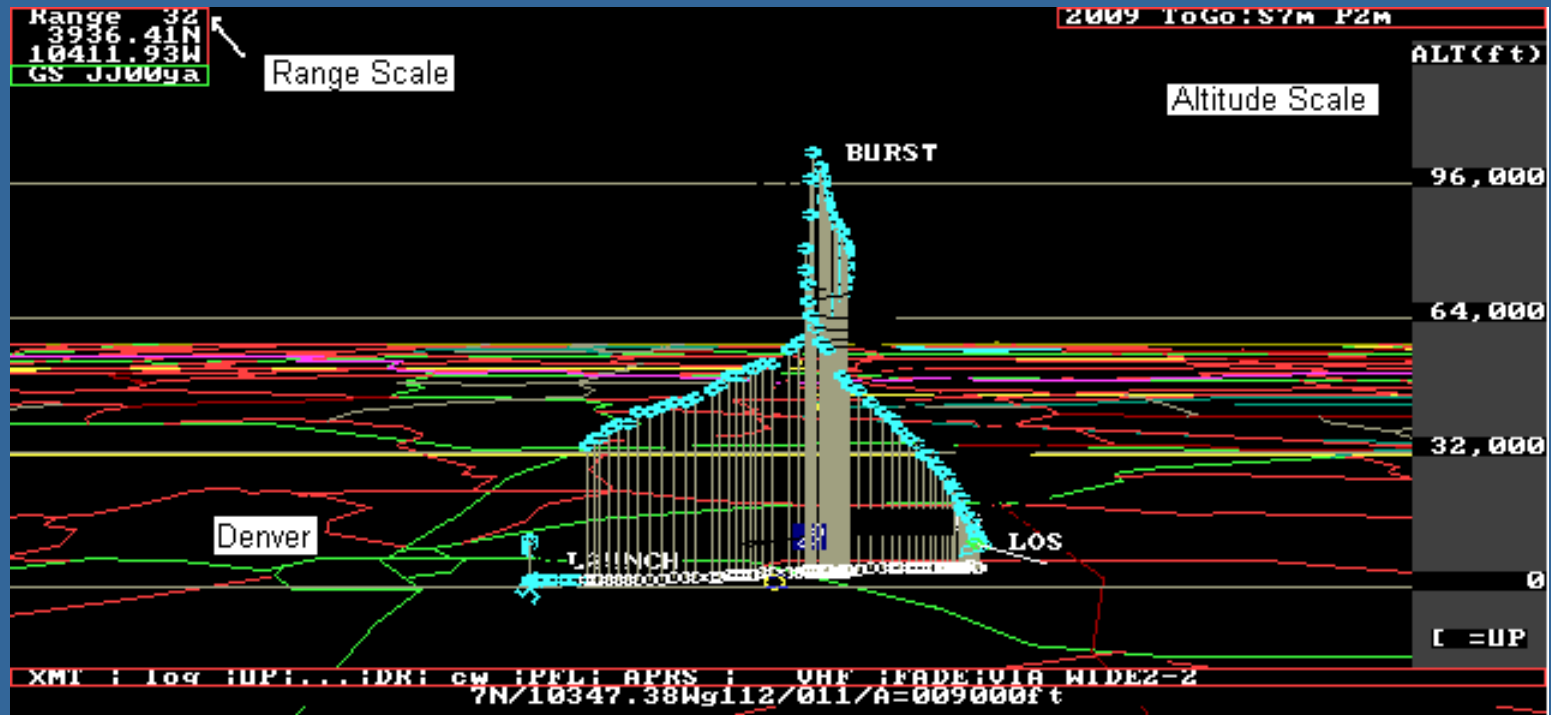
[Your ALOHA circle is your 100% saturated channel range]



MAPS-PLOT-HOPS display shows snapshot of number of hops from each digipeater to my station in Baltimore (at center of my ALOHA circle). Data is plotted from last-packet-received, so needs to be observed several times to average out circuitous packets and lucky shots.



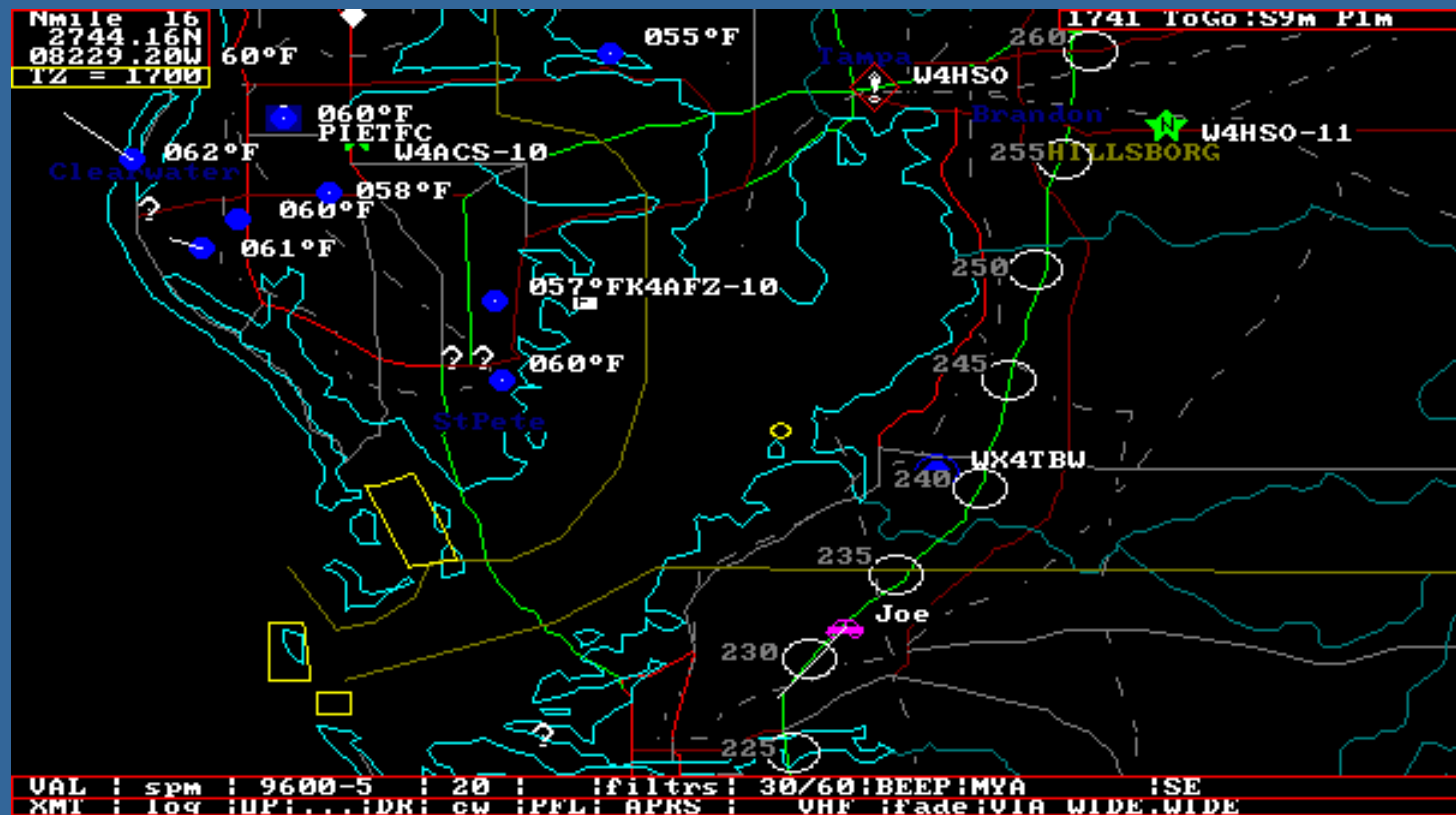
APRS 3D views for Balloon tracking



APRSDos has a 3D map display mode. The vertical scale can be separately set from the normal Range Scale depending on the altitude of objects. This is a typical APRS balloon track.



APRS Tracking with Milemarks



This APRSdos map of Tampa shows how Mile Marks can be overlaid on the map with the "MM" keys. Notice how I have placed the non-APRS mobile "Joe" on the interstate at mile mark 232 headed south west. Since APRSdos deadreckons all objects, Joe will continue to move on my map without update. This is very handy going to Dayton with many folks on the road. You can keep an eye on all the other non-APRS travelers that are in QSO range even though they have no APRS capability.



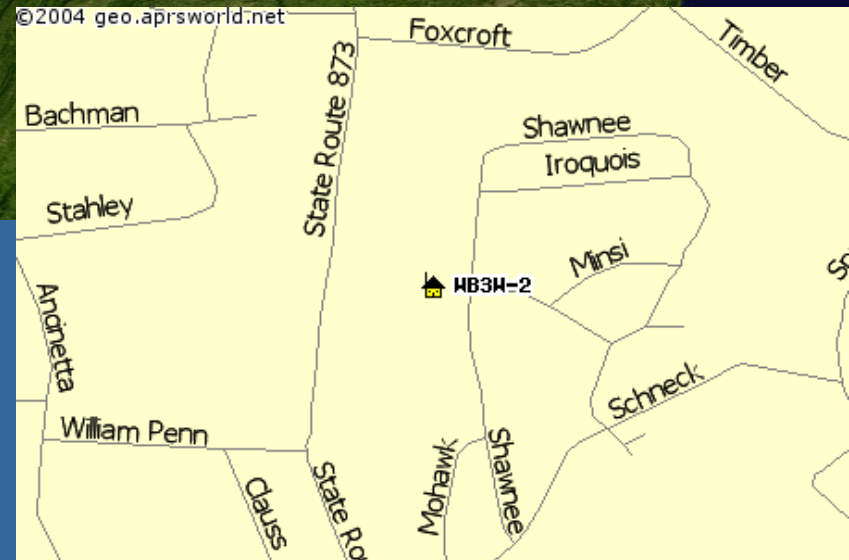
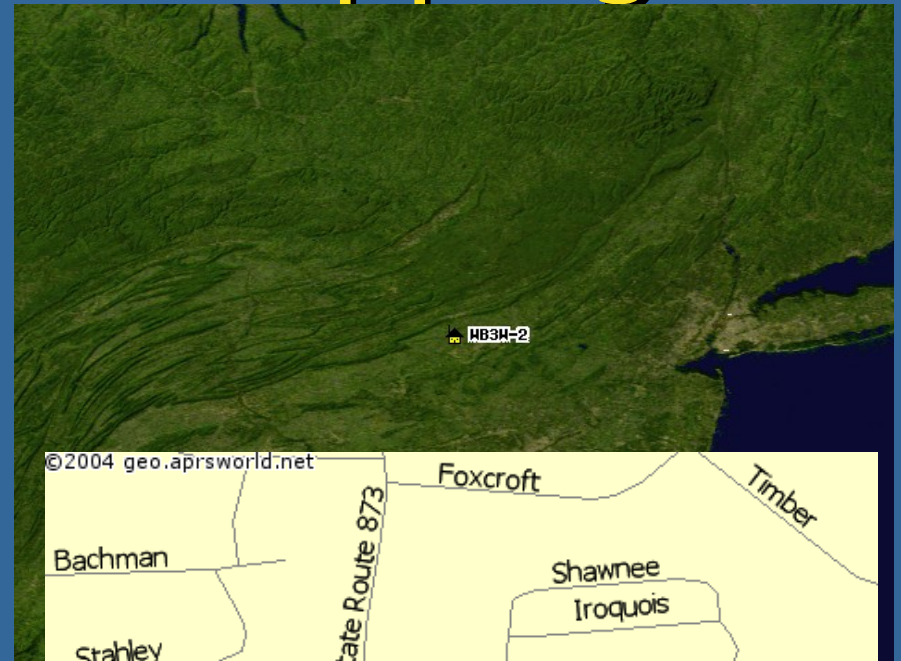
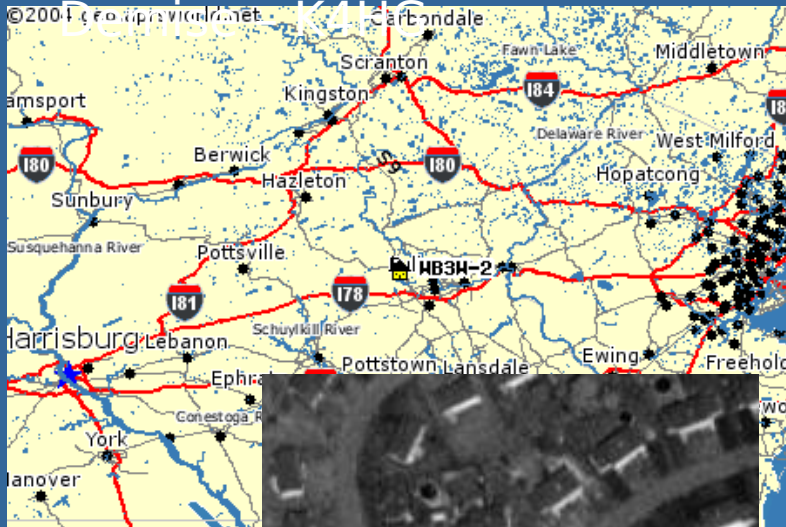
APRS IGates and SATgates

- An IGATE is a local APRS station that utilizes the APRS-Internet network to pass all packets heard on their local RF back to the Internet.
- It can also act as a gateway to pass messages addressed to local RF stations from Internet only stations.

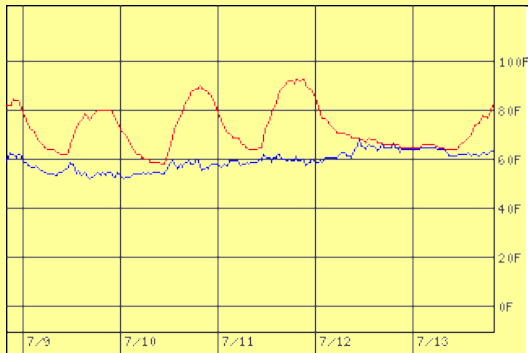


Findu.com mapping

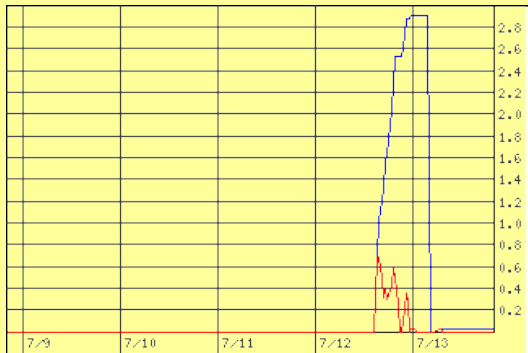
Internet tracking
developed by Steve



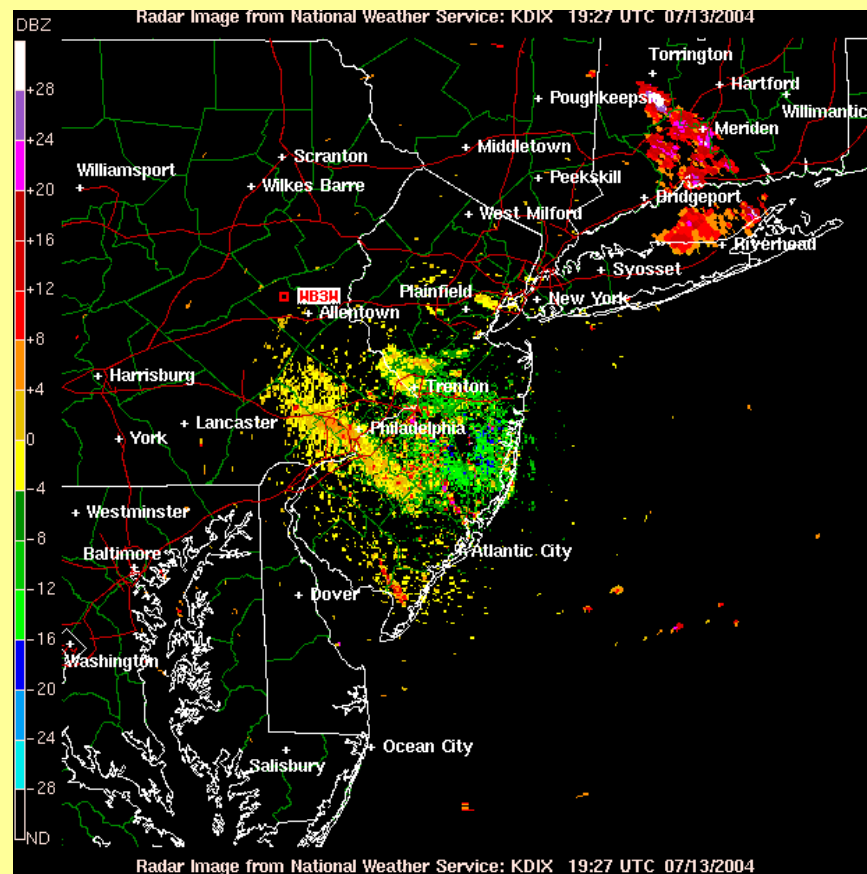
Findu.com Weather Tables



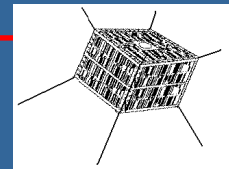
Temperature & Dew Point



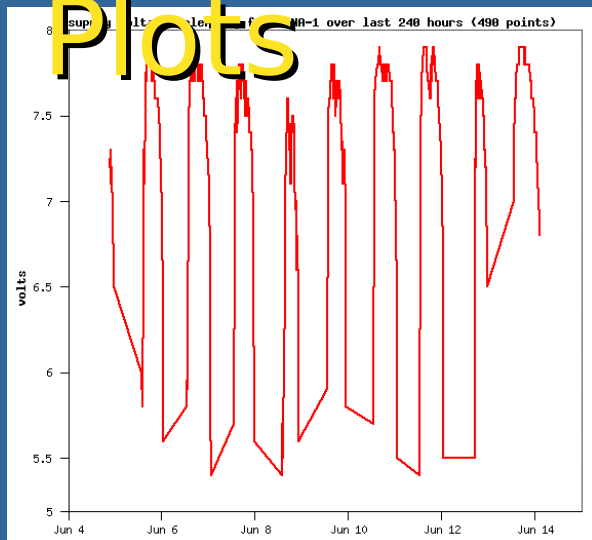
Rainfall Rates



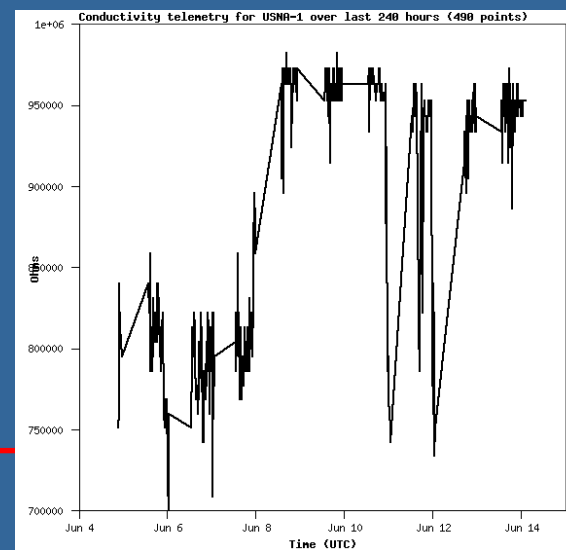
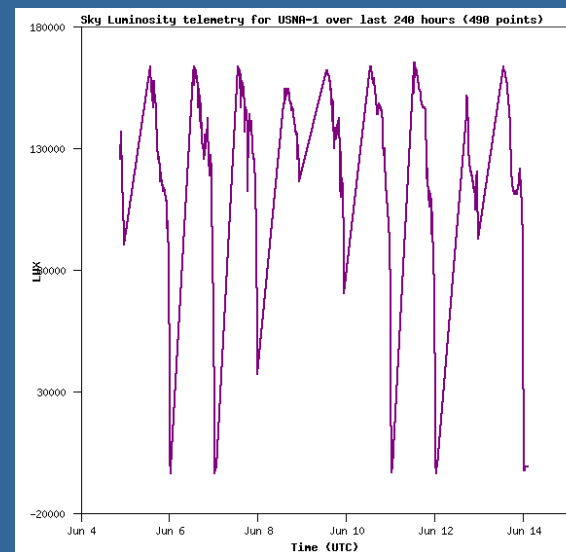
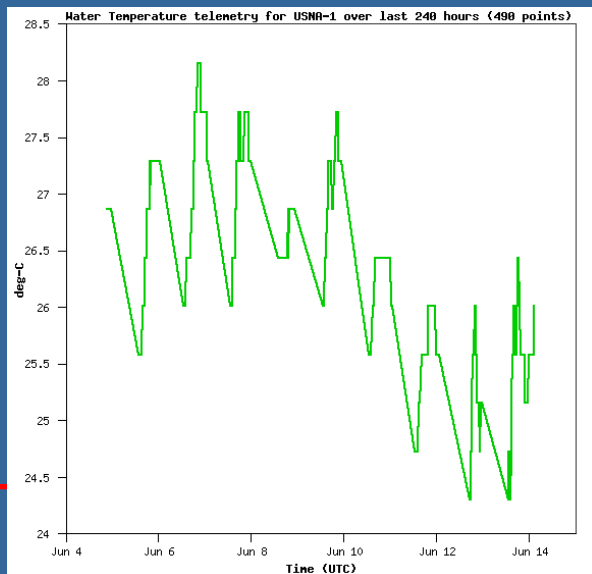
Findu.com Telemetry



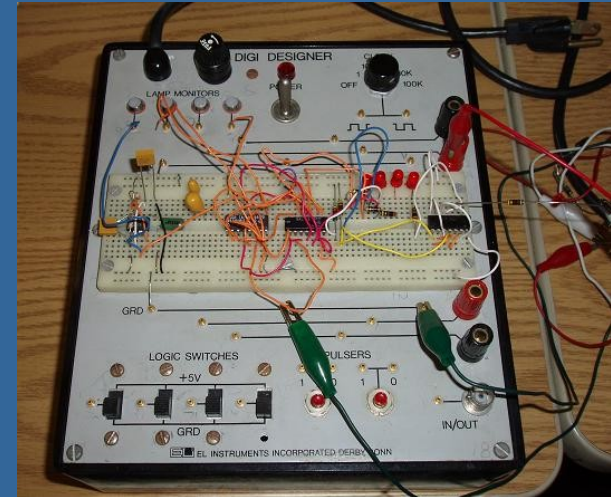
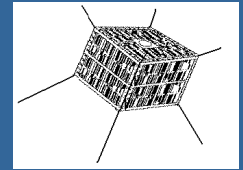
Plots



Google for
"USNA Buoy"
Select USNA-1



Sensor Buoy Prototype



- **Naval Academy Student Project** •
- * If free-floating, do not disturb.
- * If aground, move to deep water and advise bruninga@usna.edu
- * If later than 30 Nov 2006, recover and advise above.

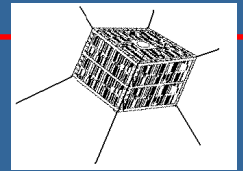
See Buoy Location and Telemetry at

<http://www.ew.unsa.edu/~bruninga/buoy.html>

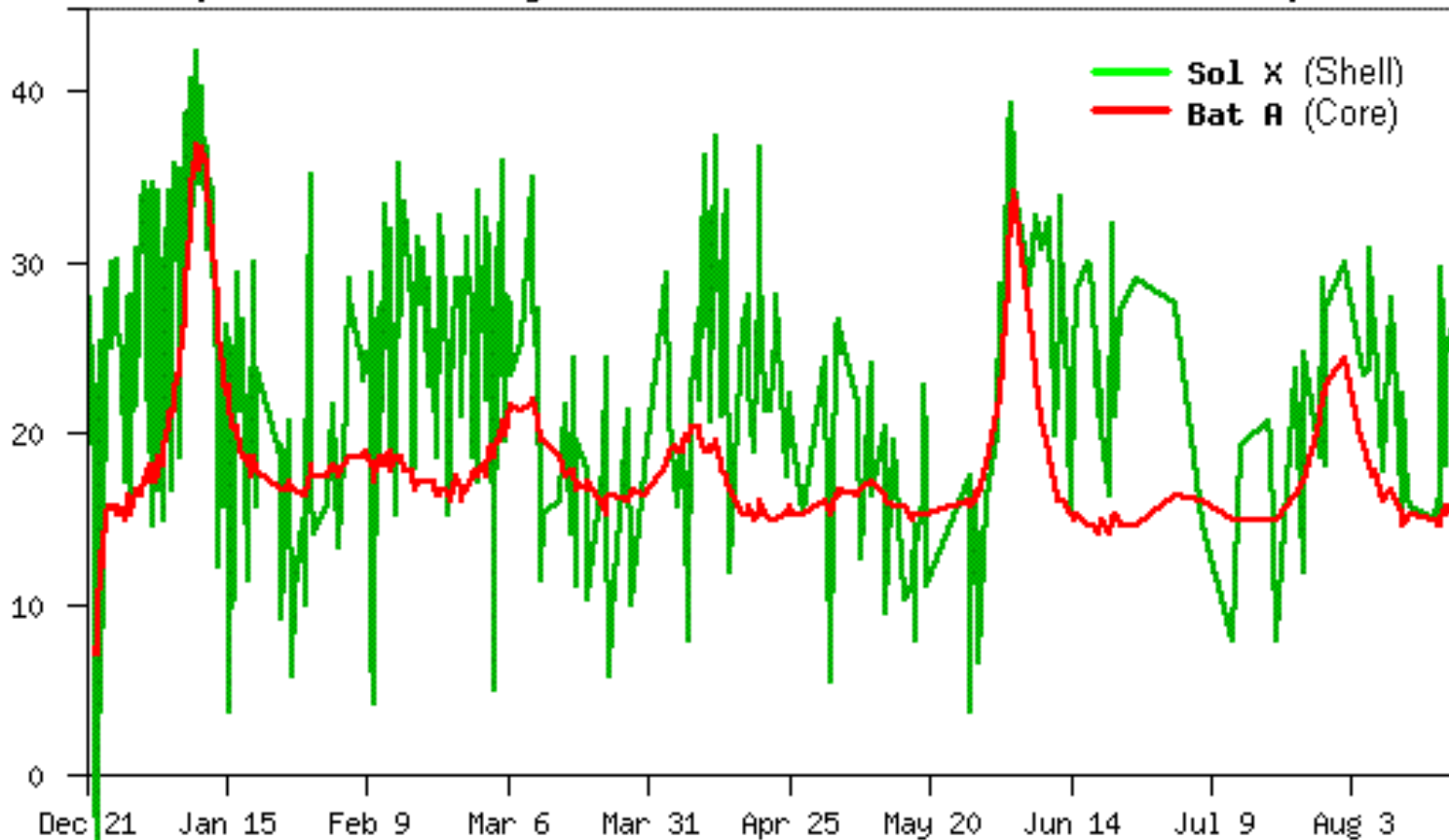


Piggrem

Findu.com Telemetry Plots



Temperature telemetry for ANDE-1 over last 5860 hours (2234 points)



APRS for Special Uses

- Bicycle rallies, races
- Walk-a-thons, Parades
- Skywarn
- Weather Nets
- Crime prevention patrols
- Damage assessment
- Direction Finding – Foxhunts
- Voice for communications, APRS for visual mapping
- Now integrating into APRN (Automatic Picture Relay Network)

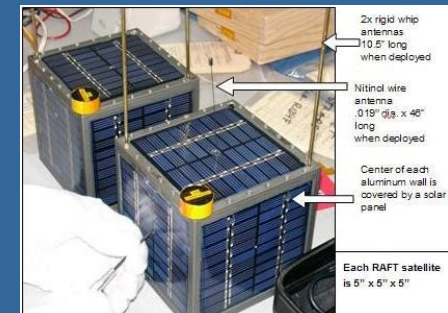


Into Space..PCSAT



ANDE and
RAFT in Dec
2006

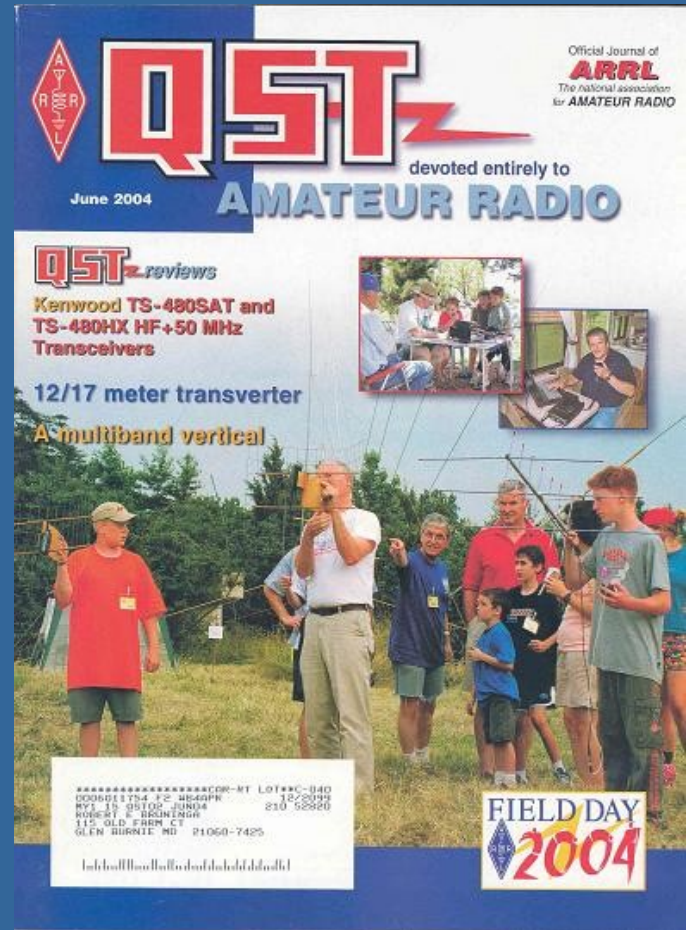
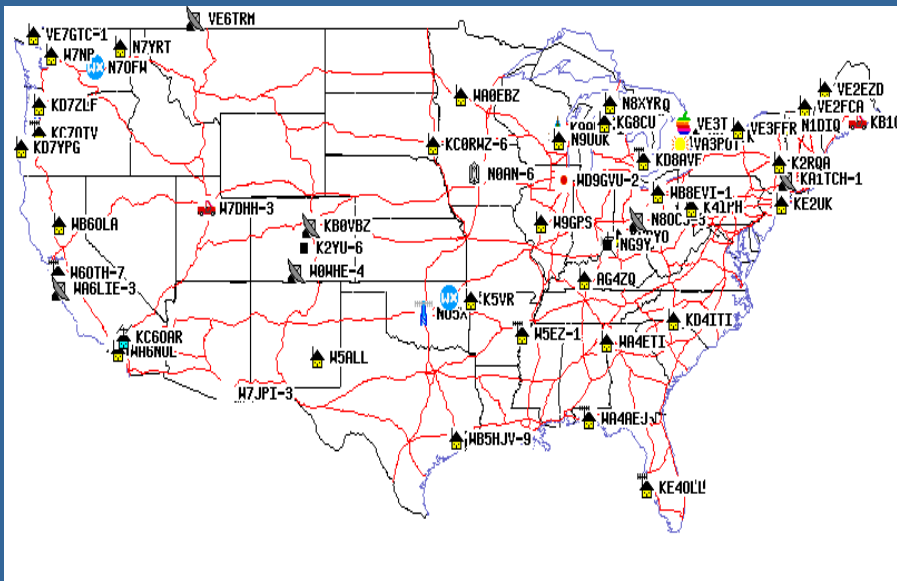
- The Prototype Communications Satellite, is a US Naval Academy Aerospace student project.



- APRS space frequency is published as 145.825



APRS via Space



- APRS space frequency is 145.825 MHz
- Also via GO-32 on 435.225 downlink, 145.85 MHz up



PCSAT Satellite



See live downlink on
<http://pcsat.aprs.org>

- Launched Sept 2001 from Kodiak Alaska
- The first APRS satellite, and has since been joined by 5 other such satellites
- It still works during mid-day sunny passes.
- Can capture Emergency /Priority messages from THD7 / D700 radios anywhere on the globe and retransmit these signals on the USA VHF 144.39 APRS frequency.



International Space Station



- ARISS supports APRS on its 145.80/145.99 packet system.
- Use digipeater path VIA ARISS.
- PCSAT2 was also on ISS 2005-2006
PCSAT2, was the second APRS digipeater satellite.

See live downlink on www.ariss.net



Now GO-32 TECHSAT-1b



- GO-32 now supports APRS on its 435.225/145.85 packet system.
- APRS up on 145.85 (PC's and messages)
- Mic-E up on 145.93 (D7 and D700's)

9600 Baud!

See live downlink on www.ariss.net



GO32 -EZ - MOBILE

Satellite

Prediction and Tracking

This table is for Washington/Baltimore but works for all points north and south.

Day1	Day2	Day3	Day4	Day5	Day6	Day7	Day8	Day9	Day1	REPEAT
0930	0910	1025	1005	0940	0920	1040	1015	0950	0930	
	1050				1055					
2050	2030	2005	2125	2100	2040	2015	2135	2110	2050	
	2210	2145				2155				WB4APR

Tracking GO-32 in the mobile is easy, because the passes repeat every 10 days. Just prepare a table like the above and stick it on your mobile dashboard, and then any day, morning or evening, you will know when the next pass you can hear will be in range. For uplink there will be a pass 100 minutes before and 100 minutes after too.

- No computer needed
- Two or more solid TX/RX passes every day
- Two additional TX passes 100m before and after!

Fri 26 Oct is day8



Tracking ECHO too!

Day1	day2	day3	day4	day5
----	----	----	----	----
0850	0950	0910	0830	0930
			1005	
2000	2100	2020	1940	2040
			2120	
for Wash DC and N/S				

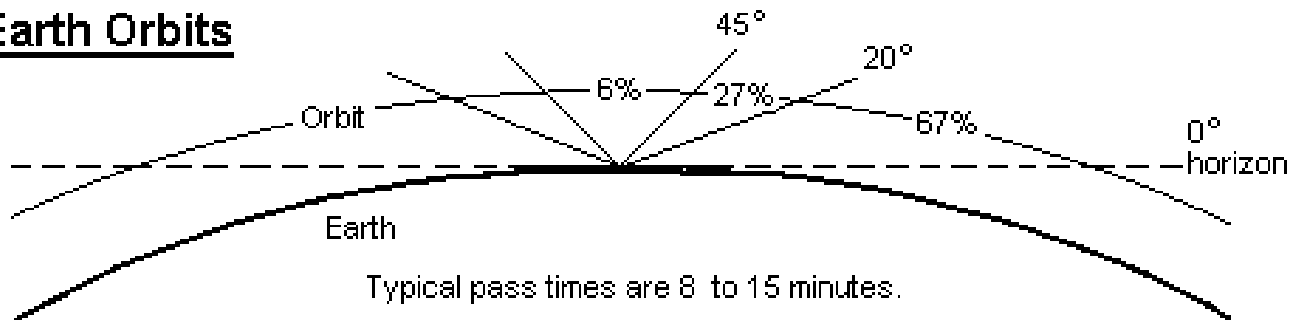
Friday October 26th is day 4!

- No computer needed
- Two or more solid passes every day

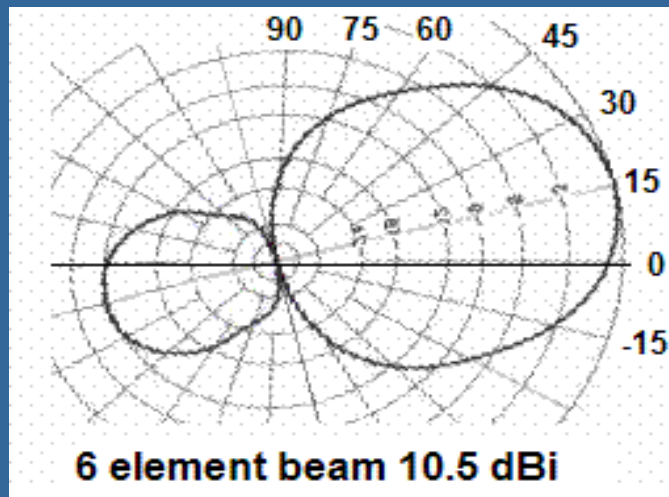


LEO Pass Geometry

Low Earth Orbits



Most of the time LEO satellites are in view, they are below 20 degrees elevation.
Rarely do they pass directly overhead. Only 2% of the time are they above 60 deg.

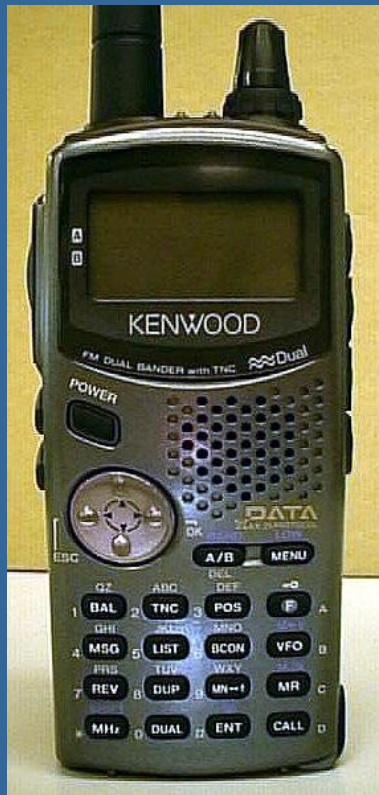


Bottom line:

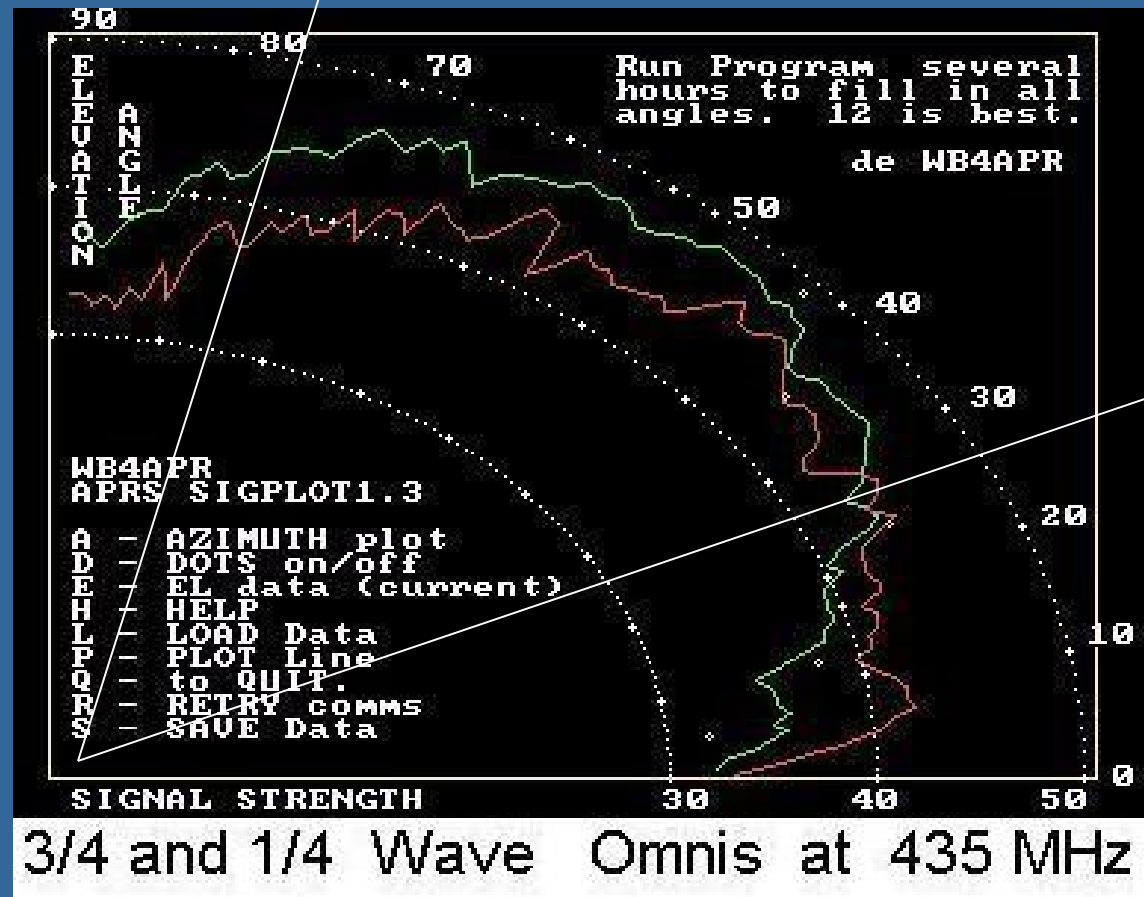
- 10 dB gain Horizon-to-horizon
- 98% of all in-view times
- Using \$75 TV rotator only



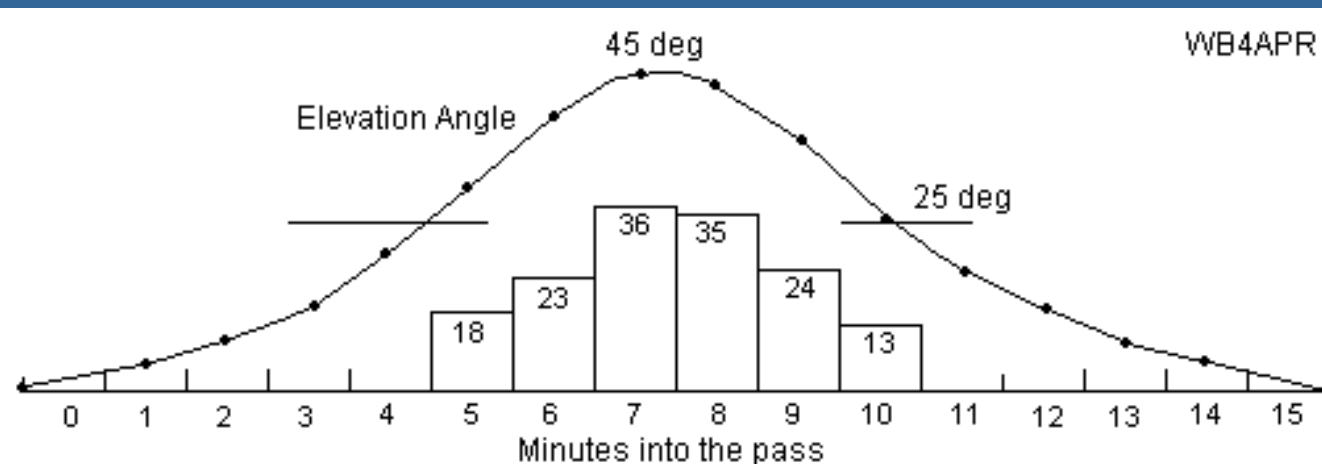
Omni Antenna Gain 7 dBi !



SATgate!



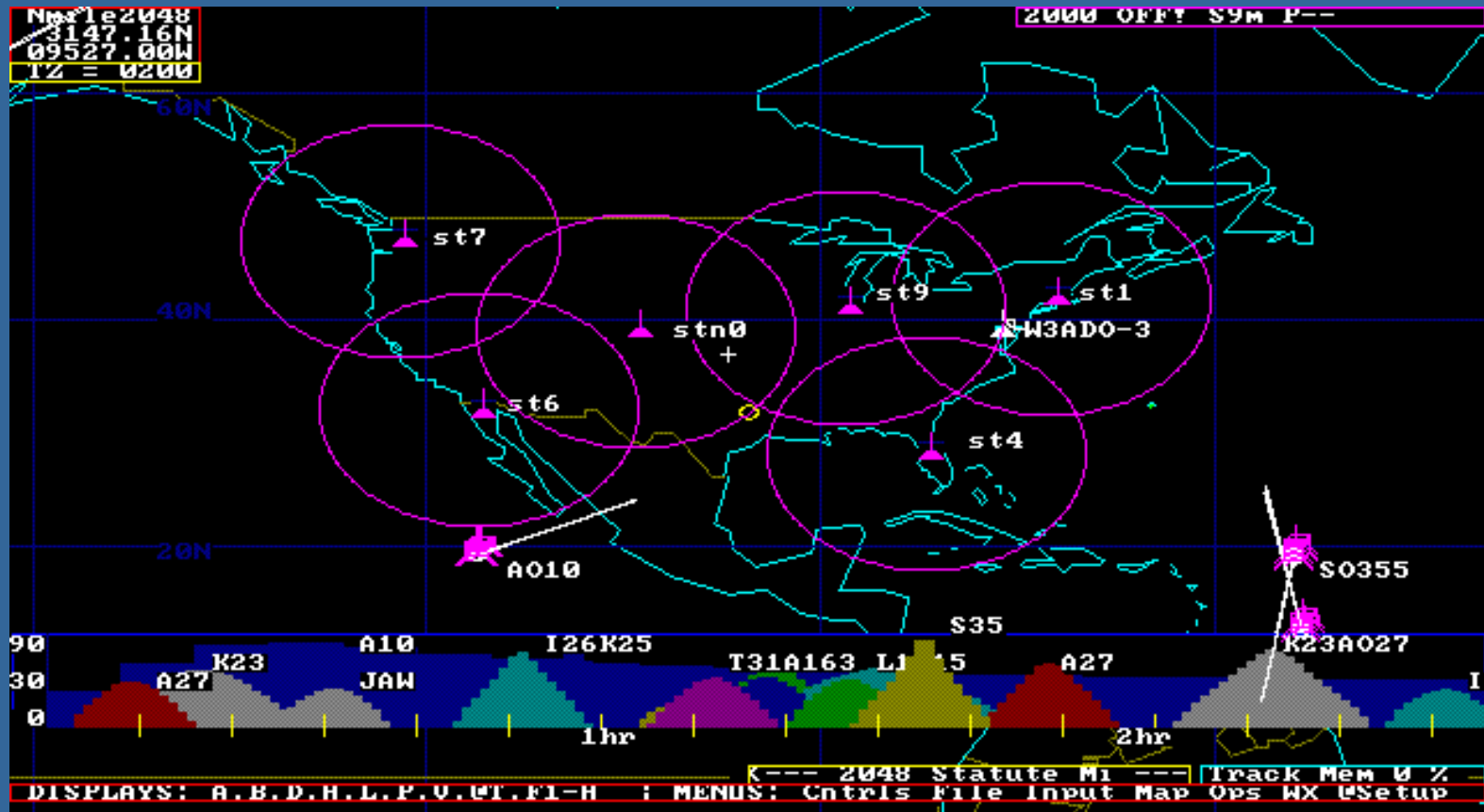
Omni SatGates



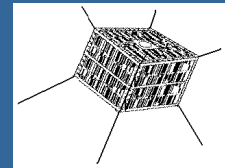
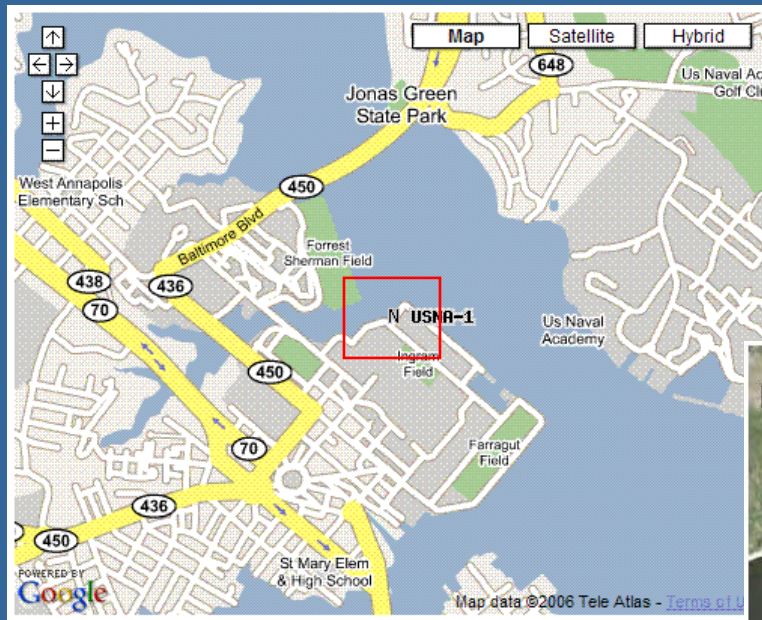
This plot shows the total packets per minute received by my TM-D700 APRS mobile radio using a mag-mount 19" whip on the roof of my car. In this case I was tracking Doppler, starting at 435.230, then 435.225, and ending at 435.220 MHz. Since the satellite is too far away at any elevation below about 25 degrees, only the central frequencies are useful.



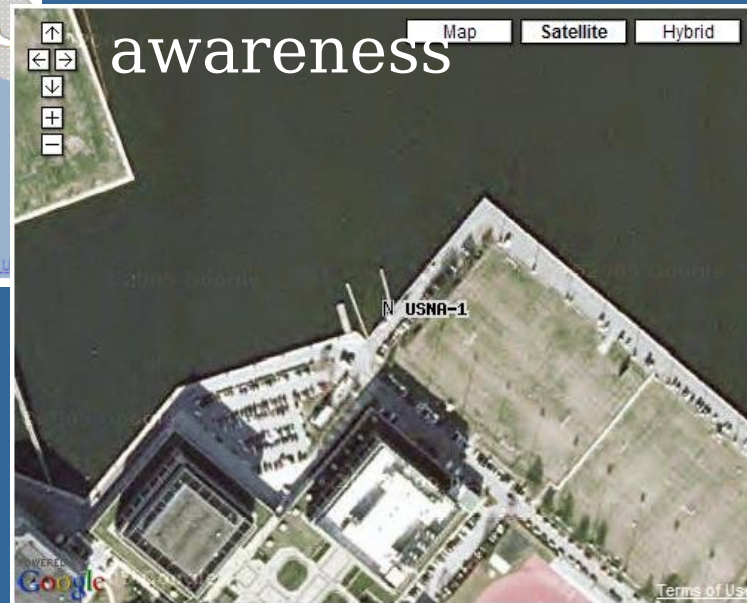
Omni SatGates



APRS-Internet (APRS-IS)



&
situational
awareness



This data is LIVE

[http://
Pcsat.aprs.org](http://Pcsat.aprs.org)



APRS-Internet (APRS-IS)

APRS Stations Near WB4APR-9 (last 240 hours)



findU links for WB4APR-9

- [Nearby APRS activity](#)
- [Raw APRS data](#)
- [Messages](#)
- [Nearest tide stations](#)
- [Metric units](#)
- [Nautical units](#)
- [Display track](#)
- [APRS Map Manager coverage](#)
- [NexRAD Radar](#)
- [Topographic map](#)
- [Aerial Photo](#)
- [APRSWorld map](#)
- [hide Google Maps](#)

External links for WB4APR-9

- [QRZ Lookup](#)
- [MSN map \(North America\)](#)
- [MSN map \(Europe\)](#)
- [MSN map \(world\)](#)
- [TopoZone](#)

Call	callbook	msg	wx	lat	lon	distance	direction	Last Position
WB4APR-9	**	**	.	39.00000	-76.50000	0.0		00:06:02:46
VA3ADG	**	.	.	38.99717	-76.50450	0.3	SW	05:22:10:17
WB4APR-1	**	**	.	38.99033	-76.49850	0.6	S	00:00:11:28
WE4APR-9	**	.	.	38.98667	-76.49283	0.9	SE	00:03:23:42
WB4APR-3	**	**	.	38.98500	-76.48550	1.3	SE	00:10:55:08
KB3KAK-9	**	.	.	39.02567	-76.50067	1.5	N	01:00:57:40
VA2JPN	**	.	.	38.97150	-76.49717	1.7	S	06:07:21:19
K3FOR-8	**	**	.	39.03200	-76.50267	1.9	N	00:08:58:06
WB1HAI-9	**	.	.	38.97067	-76.48400	2.0	SE	00:02:25:47
N3MNT-9	**	.	.	39.02117	-76.46400	2.5	NE	06:21:14:31
N3HU-9	**	.	.	39.01833	-76.44867	3.3	NE	00:02:18:02
N3KNP	**	**	.	38.97233	-76.55017	3.4	SW	04:01:37:14
W3AFE	**	**	.	39.03517	-76.45100	3.6	NE	00:02:14:24
K3TH-14	**	.	.	38.97383	-76.56283	4.1	SW	08:23:06:24
K3TH-3	**	.	.	38.97400	-76.56317	4.1	SW	00:00:14:52
N3HU	**	.	.	39.04017	-76.44183	4.2	NE	00:00:01:28



APRS-Internet (APRS-IS)

from	to	time	message
WB4APR-9	JA1RBY-4	10/25 00:07:04z	no msg list?{44
WB4APR-9		10/25 00:02:47z	qsl! {43
JA1RBY-9	WB4APR-9	10/24 23:59:59z	hello{15
N3HEV-1	WB4APR-9	10/14 14:09:06z	GM hve a grt day! 73! {0
WB4APR-9	ALL	10/14 13:53:03z	in d700... ignore that msg. It was 4 satellite. {42
WB4APR-9	ALL	10/14 13:50:24z	in d700 {41
WB4APR-9	ALL	10/14 13:49:07z	in d700 use ptt mode to TX while RXing{40
KE4NYV-15	WB4APR-9	09/30 21:55:30z	S1, if that{7
KE4NYV-15	WB4APR-9	09/30 21:51:01z	noisy{6
WB4APR-9	KE4NYV-15	09/30 21:50:32z	6.85?{38
KE4NYV-15	WB4APR-9	09/30 21:49:45z	noisy{5
N8PK	WB4APR-9	09/30 21:12:16z	Try again on 6.835 {003
WB4APR-9	KE4NYV-15	09/30 20:48:11z	52?{37
N1TI	WB4APR-9	09/29 02:47:14z	Good luck @ DCC{82
N3IDX-1	WB4APR-9	09/28 02:06:44z	Greetings from Huntingtown, Md{2b}
KD8ATF-2	WB4APR-9	09/28 01:55:17z	r u going to be on the next pass of go-32 bob?{26
WB4APR-9	ALL	09/28 01:51:40z	ck in!{35
N1TVZ	WB4APR-9	09/28 01:45:12z	%private line{M
WB4APR-9	ALL	09/28 01:43:14z	what is pl?{34
N8PK	WB4APR-9	09/28 01:40:41z	Gud 2 C U on the CARA last night! -Pat {000



Questions ? ? ?

GO-32 APRS Igate System (potential)

(End-to-End Everywhere)

